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Empowering interventions to promote sustainable lifestyles: Testing the habit discontinuity hypothesis in a field experiment



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ABSTRACT

This study tested the habit discontinuity hypothesis, which states that behaviour change interventions are more effective when delivered in the context of life course changes. The assumption was that when habits are (temporarily) disturbed, people are more sensitive to new information and adopt a mind-set that is conducive to behaviour change. A field experiment was conducted among 800 participants, who received either an intervention promoting sustainable behaviours, or were in a no-intervention control condition. In both conditions half of the households had recently relocated, and were matched with households that had not relocated. Self-reported frequencies of twenty-five environment-related behaviours were assessed at baseline and eight weeks later. While controlling for past behaviour, habit strength, intentions, perceived control, biospheric values, personal norms, and personal involvement, the intervention was more effective among recently relocated participants. The results suggested that the duration of the 'window of opportunity' was three months after relocation.

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1. Introduction

Promoting environmentally friendly behaviours is arguably one of the most difficult behaviour change targets. When people are asked opinions on environmental issues such as global warming, many will express concerns and pro-environmental attitudes (e.g., Eurobarometer, 2014; Ipsos MORI, 2015; Verplanken & Roy, 2013). But when asked what the most important issues are today, the environment usually ends up low in these rankings (e.g., BBC, 2015; Gallup, 2015). Even if events such as hurricanes, flooding, or pollution, happen on the doorstep, the environment remains a distant and nebulous entity for most people (e.g., Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Whitmarsh, 2008). Consequently, as is predicted by construal-level theory of psychological distance (Trope & Liberman, 2010), mental representations of "the environment" are not conducive to taking pro-environmental action (Spence, Poortinga, & Pidgeon, 2012). Environmental issues can also be framed as social dilemmas, that is, conflicts between immediate self-interest and longer-term collective interest, which also weaken an individual's motivation to act (e.g., Biel & Thøgersen, 2007; Lorenzoni et al., 2007). Some barriers to pro-

environmental action are straightforward, in particular when people are restrained in their options, for instance due to inadequate public transport or limited financial resources. Gifford (2011) discussed a variety of psychological barriers to pro-environmental behaviour, such as judgemental biases, social comparison processes, psychological investments in current behaviours, and mistrust in authorities. In this article we focus on habit as a particular barrier to change. We will argue that while habits are hard to break, finding opportunities where existing habits are temporarily broken may make a behaviour change intervention more effective.

Many behaviours that are considered as potential targets for behaviour change in a more sustainable direction, such as transportation, shopping, leisure activities, or water usage, are strongly habitual. Habits are learned dispositions to repeat past responses (Wood & Neal, 2007; Wood & Rünger, 2016). These behaviours are conducted frequently, usually at the same location and time, and are less guided by conscious intent (e.g., Danner, Aarts, & de Vries, 2008; Gardner, 2009; Ji & Wood, 2007; Neal, Wood, Labrecque, & Lally, 2012; Ouellette & Wood, 1998; Triandis, 1977; Verplanken, Aarts, van Knippenberg, & Moonen, 1998; Wood, Quinn, & Kashy, 2002). While the prevalent socio-cognitive models suggest that control of behaviour is anchored in an individual's motivation or willpower (e.g., Ajzen, 1991), when habits are forming some of that control shifts to the environment, that is, to the cues that elicit the

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habit (e.g., Neal, Wood, & Drolet, 2013; Neal, Wood, Wu, & Kurlander, 2011; Orbell & Verplanken, 2010; Wood & Neal, 2007; Wood, Tam, & Guerrero Witt, 2005). Habits are thus highly automatised behaviours (e.g., Aarts & Dijksterhuis, 2000; Verplanken & Orbell, 2003), or patterns of behaviour (e.g., Kurz, Gardner, Verplanken, & Abraham, 2015; Roy, Verplanken, & Griffin, 2015). This comes with a degree of 'tunnel vision', that is, a lack of choice awareness, superficial decision making, and little interest in new information, even if decision makers are explicitly asked to make deliberate choices (Aarts, Verplanken, & van Knippenberg, 1997; Verplanken, Aarts, & van Knippenberg, 1997).

The features which thus characterise habit – lack of conscious intent, a shift of behavioural control from willpower to cues, and 'tunnel vision' – are making existing habits resistant to change and thus do not bode well for behaviour change interventions. However, it is not always possible to execute a habit. Circumstances may arise or contexts may change which limit or block a habit, perhaps temporarily, and thus require considering alternative courses of action (e.g., Jones & Ogilvie, 2012). For instance, Fujii, Gärling, and Kitamura (2001) studied the effects of a temporary freeway closure on commuters. While habitual car users were likely to take a longer route rather than switching to a more efficient public transport option, some car users did try public transport and, finding out they had overestimated the travel time, continued to do so during the freeway closure. Brown, Werner, and Kim (2003) observed how car users switched to a light-rail option due to temporary parking shortages, and for some this remained a long-run choice maintained by the positive experiences. Verplanken, Walker, Davis, and Jurasek (2008) found that university employees who had recently moved house and were concerned about the environment were commuting more sustainably than those who were equally concerned, but had not relocated, suggesting that the relocation might have temporarily activated important environmental values (cf., Gatersleben, Murtagh, & Abrahamse, 2014; Verplanken & Holland, 2002).

These studies suggest that when habits are broken, this may create a "window of opportunity" for behaviour change. Change may occur spontaneously, for instance by discovering better options than the old habits, as supposedly was the case in the studies cited above. But this window may also be used strategically to promote behaviour change. Behaviour change interventions may thus be more effective when delivered in the context of major habit disruptions, such as those related to life course changes. This has been put forward as the *habit discontinuity hypothesis* (Bamberg, 2006; Verplanken et al., 2008; Walker, Thomas, & Verplanken, 2015). Major discontinuities may involve transitions to new phases in life (e.g., from education to a job), geographical or physical changes (e.g., residential or work-related relocations), or changes in the environment where habits are executed (e.g., infrastructural changes). Such discontinuities may force people to renegotiate ways of doing things, create a need for information to make the new choices, and a mind-set of being 'in the mood for change'. Interventions that capitalise on these conditions may thus be more effective compared to interventions under default conditions.

A number of studies have investigated the effects of behaviour change interventions that were intentionally delivered in the context of a discontinuity. Bamberg (2006) provided residents who recently had relocated with a 1-day free public transport ticket and information about the available public transport services. The intervention induced a significant increase in the use of public transport compared to a control group of relocated residents who did not receive an intervention. Thøgersen (2012), in a secondary analysis of an intervention study in which participants were given a free one-month public transport pass, found that the intervention was only effective among participants who had recently moved

house or work place. Walker et al. (2015) followed workers of an organisation which had relocated and initiated a sustainable travel plan in the wake of it, and demonstrated how old habits decayed and new habits established.

While the studies cited in the previous paragraph produced results that are in line with the habit discontinuity hypothesis, they did not provide a test whether the discontinuity itself had a distinct role. In other words, these studies demonstrated that interventions delivered in the wake of a discontinuity were effective, but did not contrast the effects with a default condition in which participants did *not* go through a discontinuity. The present study aimed to provide such a test in a field experiment in a middle-large city in the east of England. The study included participants who had, versus had not, recently relocated, as well as an intervention versus no-intervention control group in both segments. The intervention consisted of face-to-face interviews and the provision of information about sustainable choices. The outcome consisted of self-reported frequencies of twenty-five environmentally relevant behaviours, which were assessed at baseline and eight weeks later. The hypothesis was tested that higher frequencies of behaviour are reported in the intervention versus control group eight weeks later, but that this effect is stronger when participants had recently relocated.

The effects were controlled for key determinants of environmental behaviour at baseline; past behaviour, habit strength, behavioural intention, perceived behavioural control, biospheric values, personal norms, and personal involvement (e.g., Steg, van den Berg, & de Groot, 2014; Steg & Vlek, 2009). Past behaviour obviously served as benchmark for change. Existing habit strength was included, as this might influence the resistance to change (Lewin, 2008/1946). Intention and perceived control represented the most proximal predictors of behaviour in the theory of planned behaviour (e.g., Ajzen, 1991), and thus covered the motivation to behave environmentally friendly and the perceived ability to do so, respectively. Biospheric values, personal norms, and personal involvement represented broader motivational, normative and identity-related factors which have been found related to related to pro-environmental behaviour and behaviour change (e.g., Göckeritz et al., 2010; Sparks & Shepherd, 1992; Stern, 1992; Thøgersen & Ölander, 2002; Verplanken & Holland, 2002; Whitmarsh & O'Neill, 2010).

2. Method

2.1. Participants and design

Participants were recruited among residents of Peterborough, a city in the east of England with approximately 186,000 citizens. A total of 1612 individuals were cold-contacted at the doorstep; 800 (49.6%) were willing to participate in the study.¹ Half of the participants were known to have relocated within the previous 6 months ("movers"). These households had been identified through property websites and contacts with developers who had been active in the recruitment areas. The remaining 400 participants were recruited from the same areas ("non-movers"). Movers and non-movers were matched on house size (number of bedrooms), home ownership, recycling facilities, and access to public transport.

Participants were assigned to an intervention or a control condition. In order to avoid neighbours being assigned to different

¹ Given the fact that participants were cold-contacted, and that participation involved a relatively lengthy first session on the doorstep, we considered this percentage as rather favourable. Participants were not systematically probed for reasons for non-participation.

conditions, a clustered randomisation procedure was applied, in which geographical units were designated as intervention and control areas, respectively.

The study comprised two measurements (T1 and T2, respectively), which were approximately eight weeks apart. The measurements consisted of questionnaires, which were handed out upon recruitment and sent by post, respectively. From the original 800 participants at T1, a total of 521 (65%) submitted a completed questionnaire at T2. The final sample contained 330 females (63%) and 191 males (37%). Ages ranged from 19 to 85 years, $M = 41$ years. Participants received a £10 cash voucher and a lottery ticket for a £250 a prize draw for submitting the final T2 questionnaire.

The study received approval from the Ethics Committee in the authors' department.

2.2. Procedure and the intervention

The field work (recruitment, delivery of the intervention and data collection) was conducted by the Peterborough Environment City Trust. This organisation had developed an intervention to promote sustainable behaviours among residents who had recently relocated. This intervention was adapted and delivered in the intervention condition. Participants in the control condition only completed the T1 and T2 questionnaires.

The intervention consisted of a Personal Interview; a selection of sustainable items ("Sustainable Goodie Bag"); tailored and general information ("Green Directory"); a Newsletter. The intervention was targeted at a wide range of environmentally relevant behaviours, including water conservation, waste reduction, reducing car use, and saving gas and electricity. The intervention contained individualised as well as generic information. Multiple motives were addressed, which concerned ecological values such as preserving natural resources, as well as individual benefits such as financial savings (cf., [Steg, Bolderdijk, Keizer, & Perlaviciute, 2014](#); [Whitmarsh, 2009](#)). The individualised information was tailored in the Personal Interview, and partly tailored in the Green Directory, which also contained generic information. The Sustainable Goodie Bag and the Newsletter conveyed generic information.

2.2.1. Personal Interview

Upon agreement to participate, participants were asked to fill out a questionnaire, which formed the T1 baseline assessment. The project assistant then conducted a personal interview. The responses provided in the questionnaire were used as the basis for this conversation. The purpose of the interview was to identify behaviours the interviewees were interested in changing, potential barriers to change, and possible solutions. The project assistants were trained to use one or more of the following intervention tools: (1) addressing perceived obstacles and barriers, such as lack of information or skills; (2) providing details of obtaining financial benefits, for example by saving water, electricity, gas or fuel; (3) emphasising long-term environmental benefits for humans and the environment; (4) setting and committing to behavioural goals; (5) emphasising a "green identity"; (6) emphasising pro-environmental injunctive and descriptive norms; (7) enhancing or maintaining engagement with and attention to the ecological agenda. The project assistants kept notes of which behaviours were addressed specifically during the interview.

2.2.2. "Sustainable Goodie Bag"

Participants were offered a free re-usable shopping bag containing sustainable products. The bag contained eco-washing liquid, vegetable and flower seeds, a bus timetable, a shower timer, and a set of brochures on environmentally friendly choices.

2.2.3. "Green Directory"

An information booklet was sent out shortly after the Personal Interview. Information for each participant was selected on the basis of their expressed interest and/or lack of awareness of issues during the Personal Interview. The Directory also provided generic information by referring to websites on how to live sustainably, and emphasised both environmental as well as the financial benefits of saving resources.

2.2.4. Newsletter

Participants received twice a Newsletter from the Peterborough Environment City Trust. The Newsletters contained a variety of information about sustainable solutions and provided links to relevant websites.

2.3. Assessments

Behaviours were assessed both at T1 and T2, while all other measures were taken at T1.

2.3.1. Relocation status

Participants were asked how long ago they had moved to their current address. This was recorded in terms of weeks, months, and/or years. The time participants lived at the current address varied from one week to 32 years. A variable indicating relocation status was constructed by applying a log transformation on the number of weeks participants had lived at their current address.

2.3.2. Behaviours

Participants were asked how frequently they had performed twenty-five environmentally relevant behaviours during the last year (T1). These items were presented again eight weeks later (T2) with reference to the same time frame. The choice of behaviours was informed by behavioural goals formulated by the UK Department for Environment, Food, and Rural Affairs ([Defra, 2008](#)). The behaviours broadly covered the domains of water (e.g., taking less than 10 min in the shower; using the toilet dual flush), waste (e.g., using re-usable shopping bags; using leftover food for other meals), transportation (e.g., walking or cycling short journeys; ecologically friendly driving), and energy use (e.g., turning down the heating; washing clothes at cooler temperatures).² Frequencies of performing these behaviours were reported on 5-point scales, which were labelled "never" (1), "seldom" (2), "sometimes" (3), "often" (4), "always" (5), respectively. Because the internal reliabilities of the four behavioural domains were unacceptable (i.e., Cronbach Alpha < 0.50), the twenty-five behaviours were aggregated. Cronbach Alpha for the collective behaviours was 0.77 and 0.84 for the T1 and T2 assessments, respectively. For each participant the behaviours were thus averaged into a T1 and T2 aggregated behaviour index, respectively. High scores indicate high frequencies.

2.3.3. Habit strength

Habit strength was assessed by a shortened version of the Self-Report Habit Index (SRHI; [Verplanken & Orbell, 2003](#)). In order to keep the response load within acceptable limits, the SRHI was applied to the four behavioural domains, which were labelled as, "Using less water", "Producing less waste", "Reducing the car less for short journeys", and "Reducing gas and electricity use", respectively. For each of these categories six items from the original

² The study originally included seven more behaviours. However, these were discarded, for instance due to too little variance at T1 (e.g., almost everyone reported to switch off lights and to use fully loaded washing machines), not owning a device (e.g., a water butt), or a lack of facilities (e.g., a car sharing scheme).

twelve items contained in the SRHI were presented. Each set of items started with the stem “[Behaviour X] is something ...”, which was followed by the six items; “... I do frequently”, “... I do automatically”, “... I do without thinking”, “... that is part of my daily routine”, “... is typically me”, and “... I have been doing for a long time”. The items were chosen such that the key features of habit (the experience of repetition and automaticity) were represented (Orbell & Verplanken, 2015). Responses were reported on 5-point scales labelled as “strongly disagree” (1), “disagree” (2), “undecided” (3), “agree” (4), “strongly agree” (5), respectively. Cronbach Alpha for the four behavioural domains varied between 0.96 and 0.97. Across all items Cronbach Alpha was 0.94. For each participant the SRHI responses were averaged into an aggregated habit index. High scores indicate strong habits.

2.3.4. Behavioural intentions

For each of the four main behavioural categories participants were presented with three intentions, e.g., “In the next six months I intend to conserve water”; “I expect that I will conserve water in the next six months”; “I am not really intending to conserve water in the next six months” (reverse scored). Responses were reported on 5-point scales, which were labelled “strongly disagree” (1), “disagree” (2), “undecided” (3), “agree” (4), “strongly agree” (5), respectively. Cronbach Alpha for the four behavioural domains varied between 0.75 and 0.82. Across all items Cronbach Alpha was 0.86. For each participant the behavioural intention responses were averaged into an aggregated intention index. High scores indicate strong intentions.

2.3.5. Perceived behavioural control

For each behavioural category participants were presented with three items assessing perceived behavioural control (e.g., “I would find it easy to conserve water”; “Cutting back on my water consumption would not be hard to do”; “I don't really know how I could conserve water” – reverse scored). Responses were reported on 5-point scales, which were labelled “strongly disagree” (1), “disagree” (2), “undecided” (3), “agree” (4), “strongly agree” (5), respectively. Cronbach Alpha for the four behavioural domains varied between 0.63 and 0.77. Across all items Cronbach Alpha was 0.82. For each participant the perceived behavioural control responses were averaged into an aggregated perceived control index. High scores indicate strong perceptions of control.

2.3.6. Personal norms

For each behavioural category participants were presented with three items assessing personal norms with respect to the environment (e.g., “Conserving water is something that everyone should do”; “Because of my values and principles, I feel it is important to try and conserve water”; “I feel a moral obligation to save water for the sake of the environment”). Responses were reported on 5-point scales, which were labelled “strongly disagree” (1), “disagree” (2), “undecided” (3), “agree” (4), “strongly agree” (5), respectively. Cronbach Alpha for the four behavioural domains varied between 0.78 and 0.84. Across all items Cronbach Alpha was 0.91. For each participant the personal norm responses were averaged into an aggregated personal norm index. High scores indicate strong personal norms.

2.3.7. Biospheric values

Biospheric values were assessed by four items taken from De Groot and Steg (2008). Respondents rated the importance of “Preventing pollution: protecting natural resources”, “Respecting the earth: harmony with other species”, “Unity with nature: fitting into nature”, and “Protecting the environment: preserving nature” in terms of the extent to which they were “a guiding principle in their

lives”. The response scale used was “not at all important” (1) to “of supreme importance” (5). Cronbach Alpha was 0.91. For each participant the responses were averaged. High scores indicate strong values.

2.3.8. Personal involvement

Personal involvement was assessed by eight items, which were developed for the present study. The items covered emotional involvement (e.g., “I feel anxious about what climate change will do to us”), interest in the environment (e.g., “There are more important things to worry about than the environment” – reverse scored), and empowerment (e.g., “I feel that I can really make a contribution to a better environment”). Responses were reported on 5-point scales, which were labelled “strongly disagree” (1), “disagree” (2), “undecided” (3), “agree” (4), “strongly agree” (5), respectively. Cronbach Alpha was 0.81. For each participant the responses were averaged into a personal involvement index. High scores indicate strong personal involvement.

3. Results

All variables were screened on distribution normality, and were found satisfactory. Skewness and kurtosis values were between -0.05 and $+0.05$ for all variables, except personal involvement, for which these values were -0.98 and 1.50 , respectively, suggesting some degree of deviation from normality.

In Table 1 means, standard deviations, and correlations of the behaviour indices at T1 and T2 and the determinants of behaviour at T1 are presented. All determinants assessed at T1 were statistically significantly correlated with the behaviour indices. The correlations were as can be expected on the basis of the literature, that is, in the range of 0.30 – 0.40 .

3.1. Testing the habit discontinuity hypothesis

In order to test the main hypothesis, a multiple regression analysis was conducted. Behaviour at T2 was regressed on age, sex, behaviour at T1, the determinants of behaviour at T1 (habit, intention, perceived control, biospheric values, personal norm, and personal involvement), the intervention, relocation status, and the intervention \times relocation status interaction. The intervention was coded as -1 (control group) and $+1$ (intervention group), and relocation status was z-transformed before calculating the interaction term. The adjusted R-square was 0.46 , Cohen's $f^2 = 0.85$. The variance inflation factors varied from 1.02 to 2.28 , indicating that there were no multicollinearity problems. Details of the analysis are presented in Table 2.

While all determinants at T1 correlated statistically significantly with behaviour at T2, only behaviour at T1, habit, and personal involvement retained statistically significant regression weights. Unsurprisingly, the main effect of relocation status was non-significant. The intervention effect was statistically significant, suggesting the intervention was effective in changing behaviour in a sustainable direction. Importantly, this effect was qualified by a statistically significant intervention \times relocation status interaction, $\beta = -0.08$, $t = -2.37$, $p < .02$.

In order to inspect the nature of the interaction, simple slope analyses were conducted at the mean minus one standard deviation of relocation status, the mean, and the mean plus one standard deviation, respectively. The dependent variable was the behaviour index at T2, controlled for the behaviour index at T1 and the determinants. These analyses revealed that the intervention was most effective when participants had relocated relatively recently. The slopes showed a statistically significant effect of the intervention on behaviour change at the mean minus one standard deviation of

Table 1

Bivariate correlations between behaviour and T1 and T2 and determinants at T1.

		M	SD	2	3	4	5	6	7	8
1.	Behaviour index T1	3.15	0.57	0.34	0.30	0.29	0.28	0.35	0.33	0.62
2.	Habit T1	3.65	0.73		0.34	0.39	0.31	0.45	0.30	0.40
3.	Intention T1	3.89	0.66			0.66	0.34	0.57	0.45	0.32
4.	Perceived control T1	3.51	0.66				0.36	0.44	0.39	0.30
5.	Biospheric values T1	3.73	0.83					0.51	0.45	0.30
6.	Personal norms T1	4.24	0.64						0.49	0.38
7.	Personal involvement T1	3.45	0.61							0.41
8.	Behaviour Index T2	3.13	0.54							

Note: N = 521. All correlations are statistically significant at $p < .001$.**Table 2**

Multiple regression predicting behaviour at T2.

	B	SE B	Beta	t	Semi-partial correlation
Age	0.00	0.00	0.07	2.04*	0.07
Sex	0.00	0.04	0.00	0.06	0.00
Behaviour index T1	0.45	0.04	0.48	12.89***	0.42
Habit T1	0.11	0.03	0.15	3.79***	0.12
Intention T1	0.03	0.04	0.03	0.64	0.02
Perceived control T1	−0.01	0.04	−0.01	−0.16	−0.01
Biospheric values T1	0.00	0.03	0.00	0.11	0.00
Personal norms T1	0.03	0.04	0.04	0.84	0.03
Personal involvement T1	0.17	0.04	0.17	4.31***	0.14
Relocation status	−0.00	0.01	−0.01	−0.30	−0.01
Intervention	0.04	0.02	0.07	2.14*	0.07
Relocation status x intervention	−0.04	0.02	−0.08	−2.37*	−0.08

Note: N = 521. * = $p < .05$; *** = $p < .001$.

relocation status, $\beta = 0.20$, $p < .001$, 95% CI between 0.08 and 0.32, and at the mean, $\beta = 0.09$, $p < .04$, 95% CI between 0.01 and 0.18, while there was no significant effect at the mean plus one standard deviation, $\beta = -0.01$, 95% CI between −0.14 and 0.11.

Because part of the information provided during the intervention was individualised, the multiple regression was re-run with the behavioural composites of participants in the intervention condition being replaced by composites of only the behaviours that were specifically addressed during the Personal Interview. Using these tailored scores, the results were very similar to those reported above, and included again the statistically significant intervention x relocation status interaction, $\beta = -0.08$, $t = -2.43$, $p < .02$.

3.2. Investigating the ‘window of opportunity’

Tentatively, we investigated the actual time frame during which the intervention was most effective after participants had relocated. In other words, given that a habit discontinuity effect was present, how wide was this ‘window of opportunity’? While relocation status had been log-transformed in the previous analyses, in this case the raw number of weeks since relocation was used. As half of the total sample was recruited to have relocated within the previous 6 months, the sample was split as closely as possible into quartiles, i.e., participants who relocated less than 3 months previously, 3–6 months, 6–200 months and over 200 months, respectively. In Fig. 1 the mean behaviour composite scores at T1 and T2 in the intervention and control conditions are graphically presented for the four groups. The figure also provides the test of

the intervention effect in each group.³ This breakdown suggests that the intervention was effective during the first three months after relocation, after which no effects could be detected.

4. Discussion

This study tested the hypothesis that an intervention delivered in the wake of a major discontinuity (residential relocation) is more effective than if the intervention is delivered under default conditions. The rationale behind the hypothesis is that when old habits are temporarily disturbed, people may be more sensitive to new information and adopt a mind-set that is conducive to behaviour change. The results of the study gave support to this hypothesis. While controlling for baseline levels of past behaviour, habit strength, intentions, perceived control, biospheric values, personal norms and personal involvement, and pitted against a no-intervention control group, participants who received an intervention and had recently relocated reported more change eight weeks later on a composite of twenty-five environment-relevant behaviours compared to participants who had not recently relocated. Although other studies have produced results that were in line with the habit discontinuity hypothesis (Bamberg, 2006; Brown et al., 2003; Fujii et al., 2001; Jones & Ogilvie, 2012; Thøgersen, 2012; Verplanken et al., 2008; Walker et al., 2015), the field experimental design of the present study provided a more rigorous test of the hypothesis. Unlike the above mentioned studies, which were either correlational and/or included samples in which all participants had been subjected to a discontinuity of some sort, the present study was thus able to demonstrate the effect of the discontinuity *per se*.

There are a number of caveats to consider. The effect size of the extent to which relocation boosted intervention effects was small. More than anything else, the results should be considered as ‘proof of concept’. Two conditions made the present test very conservative. The first is that for an individual participant not all behaviours

³ In this case the behaviour scores were not controlled for demographics and determinants. If the significant covariates presented in Table 1 are used to control for the analyses in the subgroups, the results are similar, i.e., a statistically significant effect of the intervention for participants who relocated within the previous three months, $F(1,142) = 8.19$, $p < .01$, and non-significant effects in the three remaining groups, $F(1,116) = 0.27$, $F(1,112) = 0.31$, and $F(1,141) = 0.49$, respectively.

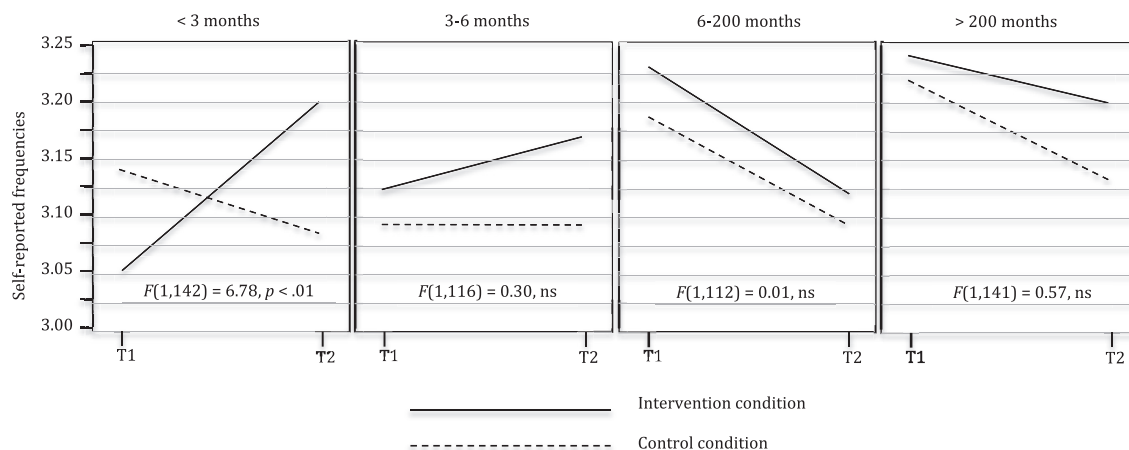


Fig. 1. Breakdown of T1 and T2 mean behavioural composite scores into four relocation status groups and tests of the intervention effect.

were relevant, and only a selection of these were addressed in the Personal Interview. Secondly, the discontinuity effect was controlled for major determinants of behaviours, that is, past behaviour, habit, perceived behavioural control, and a set of motivation variables, which, as can be expected, explained most of the variance in T2 behaviour. The test of the discontinuity effect was thus confined to the mere additional contribution of relocation.

The discontinuity effect was evident when using the highest level of aggregation of behaviour and the corresponding aggregates of habit, intention, perceived control and personal norm.⁴ First, the intervention was partly tailored, and thus focused on different behaviours for different participants, which provided a compelling argument for aggregation. Second, aggregation makes sense from a reliability point of view. In a seminal paper, Weigel and Newman (1976) showed that when single behavioural criteria were aggregated into an overall behavioural index, this measure correlated 0.62 with a general environmental attitude measure, compared to an average of 0.29 when single criteria were used. While that paper focused primarily on the issue of attitude-behaviour consistency, it demonstrated that, in line with the principles of test theory, combining multiple indicators provides a more reliable instrument. In order to provide the most rigorous test of the discontinuity effect, we thus also aggregated the behaviour-specific determinants (habit, intention, perceived control, personal norm) at the highest level. A fair question can be posed about the psychological meaning of these aggregates, as these do not have one-to-one connections to specific behaviours. Our view is that, if anything else, the aggregates might be considered as behavioural, motivational, and normative representations of higher order sustainability or ecological values. One of our reviewers suggested that the aggregated habit variable might capture variation in self-identity, in this case a “green” identity (e.g., Sparks & Shepherd, 1992; Stern, 1992; Thøgersen & Ölander, 2002; Verplanken & Roy, 2013; Whitmarsh & O'Neill, 2010), which would thus also elucidate why habit retained a significant regression weight (Table 2). The latter suggested that variations in existing habit strength modulated behaviour change over and above the discontinuity effect.

While the results undoubtedly have theoretical significance, the

practical implications are limited unless circumstances are found or created under which larger effect sizes can be realised. The latter may be accomplished in a variety of ways. For instance, larger effect sizes can be expected when interventions focus on single or small sets of behaviours (e.g., recycling, eco-driving, saving water; e.g., Abrahamse, Steg, Vlek, & Rothengatter, 2005). Effect sizes may increase by selecting and/or combining treatments. On the basis of a meta-analysis of 253 intervention studies in the domain of pro-environmental behaviours, Osbaldiston and Schott (2012) found that interventions that included cognitive dissonance, goal setting, social modelling and the use of prompts showed the largest effect sizes. Combining such tools with a discontinuity approach may thus lead to more powerful interventions. Finally, interventions may be more effective when these are carried forward by groups or communities which generate social support (e.g., Abrahamse et al., 2005; Staats, Harland, & Wilke, 2004; Weenig & Midden, 1991).

Interventions and behaviour change cannot be seen in isolation from wider systems in which they occur (e.g., Hawe, Shiell, & Riley, 2009; Lewin, 2008/1946). A ‘system’ may be defined by geographical location, such as a residential area. This comes with an infrastructure and bundles of behaviours, such as driving children to school or shopping in that area. Relocation thus unfreezes such patterns. It is therefore interesting to focus on relatively large-scale discontinuities, which are confined to a specific location and time frame, such as when a new residential area is being built. These situations provide easy access to relatively large groups of residents, who are all undergoing the same life course change in the same time period. Other ‘systems’ may be culturally defined, such as social practices, for instance those involving hygiene or leisure activities (e.g., Kurz et al., 2015; Reckwitz, 2002; Shove, Pantzar, & Watson, 2012). Social practices also involve infrastructures and bundles of habits, and are empowered with a shared meaning (e.g., hygiene standards). When individuals move into a new phase, such as a transition from school to work, starting a family or entering retirement, the habits defined by a social practice are subject to change, and may thus be interesting targets for interventions.

Habit discontinuities may also be considered from a stage model perspective (e.g., Bamberg, 2013; Dahlstrand & Biel, 1997; Gollwitzer, 1990; Prochaska & Velicer, 1997). Stage models of behaviour change distinguish a motivational phase and a volitional or execution phase. The motivational phase is characterised by deliberation, prioritising goals, and forming intentions. In the volitional phase goals and intentions are subsequently enacted. One of the issues in these models is why, how, and when an individual moves from a motivational to a volitional phase. A habit

⁴ When the analyses were conducted on disaggregated indices and respective determinants, the intervention x relocation status interactions were in the same direction, but were statistically significant for transport-related behaviours, marginally significant for waste-related behaviours, and nonsignificant for water- and energy-related behaviours. Similarly to the aggregated analyses, the effects were confined the first three months after relocation.

discontinuity may be conducive to instigating such a transition, and may thus facilitate the transition from contemplation to action (e.g., Gollwitzer, 1990; Holland, Aarts, & Langendam, 2006). A prerequisite is that a motivation to adopt the new behaviours is present in the first place, which needs to be genuine and self-related in order to have the potential to translate into action (e.g., Bamberg, 2006; Verplanken & Holland, 2002; Walker et al., 2015; Whitmarsh & O'Neill, 2010).

The present study has a number of limitations. An obvious limitation is that behaviours were assessed by means of self-reports, which are vulnerable to social desirability and consistency biases. We opted for investigating a broad spectrum of behaviours. This put constraints on the types of measurements that were feasible. However, even if the self-reports contained a degree of bias, this cannot explain why a habit discontinuity effect was found. In other words, it is difficult to argue that biases would be stronger among those who recently relocated. The choice for breadth (many behaviours) also put restrictions on the assessments of behaviour-specific determinants (habit, perceived control, intention, personal norm), which could only be measured at the level of behaviour category (e.g., saving water). This introduced a lack of correspondence. Another limitation was that we had no a-priori foundation for defining what exactly a “recent” relocation is, and the chosen cut-off period of six months was arguably arbitrary. This points to a wider issue with respect of discontinuity hypothesis, namely the question what determines the size of what we referred to as the ‘window of opportunity’, and the time when discontinuity effects can be expected to occur (cf., Jones & Ogilvie, 2012). A disruption is a temporary condition, and once a person has settled into the new situation, old habits may easily be re-activated (e.g., Walker et al., 2015; Wood & Rünger, 2016; Wood et al., 2005). The present results suggest that in this case the ‘window’ was approximately three months wide. It can be argued that the dynamics of a discontinuity effect may not be confined to a period after the event itself. For instance, in the case of relocations, behaviours such as more efficient commuting may be the very reason for a relocation. The window of opportunity may thus open before the actual discontinuity takes place.

5. Conclusion

Prevalent models of behaviour and behaviour change may lead to the suggestion that people change attitudes and behaviour only if the alternatives offered are sufficiently convincing or beneficial. This leaves the context in which interventions are delivered out of the equation, and reflects a rather static view of human behaviour. The habit discontinuity approach focuses on contexts in which people are undergoing life course changes. Those moments of change, when minds and behaviours temporarily unfreeze, may provide precious opportunities for adopting healthier and more sustainable lifestyles.

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